

APPARATUS AND METHOD FOR SELF-CENTERING  
A WAFER IN A SPUTTER CHAMBER

Field of the Invention

001        The present invention generally relates to an apparatus and a method for loading a wafer into a physical vapor deposition chamber and more particularly, relates to an apparatus and a method for self-centering a wafer onto a wafer pedestal situated in a physical vapor deposition chamber.

Background of the Invention

002        Physical vapor deposition (PVD) or sputter deposition is a frequently used processing technique in the manufacturing of semiconductor devices that involves the deposition of a metallic layer on the surface of a semiconductor device. The physical vapor deposition technique is more frequently known as a sputtering technique. In more recently developed semiconductor fabrication processes, the sputtering technique is used to deposit metallic layers of tungsten or titanium tungsten as contact layers.

003 In a sputtering process, inert gas particles such as those of argon or nitrogen, are first ionized in an electric field to produce a gas plasma and then attracted toward a source or a target where the energy of the gas particles physically dislodges, i.e., sputters off, atoms of the metallic or other source material. The sputtering technique is very versatile in that various materials can be deposited utilizing not only RF but also DC power sources.

004 In a typical sputter chamber, the major components utilized include a stainless steel chamber that is vacuum-tight and is equipped with a helium leak detector, a pump that has the capacity to reduce the chamber pressure to at least  $10^{-6}$  torr or below, various pressure gauges, a sputter source or target, a RF or DC power supply, a wafer holder, a chamber shield and a clamp ring. The sputter source is normally mounted on the roof of the chamber such that it faces a wafer holder positioned in the center of the chamber facing each other. The sputter source utilized can be a W or TiW disc for a process in which W or TiW is sputtered. A typical sputter chamber is that supplied by the Applied Materials, Inc. of Santa Clara, CA. under the trade name of Endura® 5500. In

some of the sputter chambers, the wafer holder is structured as a pedestal which includes an internal resistive heater.

005        One of the more important component in the sputter chamber is the clamp ring which serves two purposes during a sputter process. The first purpose is to clamp the wafer to the pedestal heater. The clamp ring holds the wafer in place on the pedestal when a positive gas pressure is applied between the heater and the pedestal such that heat can be efficiently conducted from the heater to the wafer. The second purpose served by the clamp ring is to allow a predetermined flow of argon to leak from under the wafer into the sputter chamber. The clamp ring is generally constructed in a circular shape with an oriented cut-out to match a wafer's flat contour. A hood is built into the clamp ring and is used for shadowing purpose to protect the lip of the clamp ring from being coated by the sputtered metal particles. The lip portion also allows the force of the clamp ring to be evenly distributed around the wafer.

006        A cross-sectional view of a typical sputter chamber 10 is shown in Figure 1. Sputter chamber 10 is constructed by a stainless steel chamber body 12 that is vacuum-tight, a sputter